Results: Twenty fetuses with CR were diagnosed at a mean gestational age of 28.4+/-6.0 weeks, with the majority being referred for suspected cardiac pathology (80%). Eighteen had multiple and 2 had single tumors. Of 19 continued pregnancies, spontaneous intrauterine demise occurred in 1 and 18 were delivered at term. Ten had dysrhythmias before or after birth. Although none had cardiovascular compromise before birth, after birth 4 had cardiac symptoms requiring medical therapy, and 3 required surgical resection of the tumor for critical left heart obstruction. On follow-up, 15 of 19 with available outcome had evidence of TSC (79%), including 6 with clinical neurodevelopmental disease (ND).
Over the same period, 26 patients were diagnosed with CR postnatally. Most cases (77%) were referred for cardiac assessment following findings suggestive of TSC. CRs were single in 5 and multiple in 21. On follow-up, the diagnosis of TSC was confirmed in 25 (96%, 5 with single and 16 with multiple tumors), including 22 with clinical ND. Six had cardiac symptoms necessitating medical (n=1) or surgical intervention (n=5). The incidence of cardiac symptoms and TSC was not statistically different between the prenatal and postnatal diagnosis groups. However, the incidence of ND was significantly higher in the postnatal diagnosis group (p = 0.007). Conclusions: Cardiac symptoms occur in 35% and TSC occurs in 79% of prenatally diagnosed CR. Despite differences in indications for cardiac assessment, the incidence of cardiac symptoms and TSC is not statistically different between pre and postnatally diagnosed CR. Fetal CR, however, may be associated with less severe clinical manifestations of TSC.

POSTER SESSION

## 1120 Neonatal Congenital Heart Surgery

Monday, March 31, 2003, Noon-2:00 p.m.
McCormick Place, Hall A
Presentation Hour: Noon-1:00 p.m.

### 1120-158 Early Outcome Following Arterial Switch Operation for Infants Presenting Late With Transposition of the Great Arteries With Intact Ventricular Septum

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**Background:** Infants presenting late with transposition of the great arteries and intact ventricular septum (TGA/IVS) may not tolerate arterial switch (ASO) if the left ventricle (LV) is not adequately prepared. The age limit and pre-operative hemodynamic predictors of tolerance of primary ASO are unknown. **Methods:** Clinical charts, echocardiograms and catheterization data of patients presenting "late" (greater than three weeks old) with TGA/IVS between 1998-2002 were analyzed. Echo measurements included shortening fraction (SF), indexed LV posterior wall thickness (PWT) in end diastole, and LV geometry ratio (ratio of the superoinferior and anteroposterior transverse axis in the short axis view). Catheterization data included left to right ventricle pressure ratio and end diastolic pressure. Results are expressed as median and range. **Results:** 12 patients presented late with TGA/IVS. Six underwent a Senning procedure at the discretion of the surgeon and were excluded from the analysis. Six underwent primary ASO. Associated diagnoses included dextrocardia, left pulmonary artery stenosis, and aortic coarctation in one patient, hemodynamically insignificant VSD in two patients, and patent ductus arteriosus in two patients. Pre-operative data included age 69 days (22-121), PWT 13.6 mm/m$^2$ (12.5-17.4), SF 0.65 (0.47-0.67), LV geometry ratio 3.2 (2.0-9.1), left to right ventricle pressure ratio 0.53 (0.51-0.70), LV end diastolic pressure 5.0 mmHg (4-7), and saturation 64% (57-67). Post-operative data included duration of ventilatory support 140 hours (22-187), vasodilator/inotropic support 127 hours (37-165), PWT 21.2 mm/m$^2$ (16.7-23.3), and SF 0.48 (0.40-0.53). There were no deaths or use of LVAD or ECMO support. **Conclusion:** This study presents some of the oldest patients undergoing successful late ASO without LV pre-training. This cohort of patients tolerated ASO despite pre-operative age or hemodynamics that might normally have precluded successful ASO. Associated anomalies, although hemodynamically insignificant at the time of presentation, may have delayed the course of LV deconditioning. Standard criteria for successful late ASO remain unknown.

### 1120-159 Outcome of Arterial Switch Operations in Infants With Abnormal Coronary Patterns

Jonah Odim, Michael Weaver, Vivek Allada, Azie Alikhani, David Gjertson, Hillel Laks, David Geffen School of Medicine at UCLA, Los Angeles, CA

Objective(s): To determine the short and long-term outcome of the arterial switch operation in infants with normal and abnormal coronary artery patterns.
Methods: An observational and retrospective analysis was conducted of the experience with the arterial switch operation (ASO) at one institution over the span of 15 years, from 1985 through 2000. One hundred and eighty-four consecutive ASO's were performed by the same surgeon. Of 184 coronary artery patterns, 141 (77%) and 43 (23%) were normal and abnormal respectively. These were classified into 4 groups: 141 in Group 1 (77%) had the typical dual arrangement (1 AD, Cx; 2R), 22 infants (12%) in Group 2 had a dual system other than the typical, Group 3 comprised 9 (5%) with a single coronary system and there were 12 (7%) in Group 4 with any pattern that included an intramural coronary course or commissural take-off. Results: There was no difference in weight at operation, gender, preoperative inotropic support, presence of VSD and RVOTO between the normal and abnormal groups. There was no difference in the early mortality rate for the normal, 6 out of 141 (4%), and the abnormal coronary patterns, 3 out of 43 (7%) (p=0.41). However, there were 4 (3%) and 3 (8%) late deaths in the normal and abnormal groups (p<0.05). Conclusion: The existence of abnormal coronary patterns is not a risk factor for early mortality after arterial switch operation; however, this anatomy may play a role in late mortality and deserves further study. br />

The Presence of VSD and its Effect on Mortality in the ASO

| Interventricular Septum | Coronary Pattern | | | |
|---|---|---|---|---|
| | Type I | Type II | Type III | Type IV |
| VSD | 63 (45%) | 12 (54%) | 4 (44%) | 4 (33%) |
| Early/Late Mortality | 3 / 3 | 1 / 1 | 1 / 0 | 1 / 0 |
| Non-VSD | 78 (55%) | 10 (45%) | 5 (56%) | 8 (67%) |
| Early/Late Mortality | 3 / 1 | 0 / 1 | 0 / 0 | 1 / 0 |

### 1120-160 Optimizing Arterial Switch Outcomes in Medium-Sized Programs by Regional Sharing

George Alfieris, Gul H. Dadlani, Roger P. Vermilion, Frank C. Smith, Nader H. Atallah-Yunes, Carol E. Dawson, Regina C. Cable, Endel J. Orav, Winston E. Gaum, Steven E. Lipshultz, University of Rochester School of Medicine, Rochester, NY

**Hypothesis:** Minimal morbidity and mortality in Arterial Switch Operations (ASO) can be achieved in medium-sized cardiac programs by regionally sharing a full-time congenital heart surgeon.
**Methods:** All ASO pts were evaluated for 30-day mortality/morbidity at Upstate Med Center in Syracuse, NY and Univ of Rochester Med Center in Rochester, where 150-200 congenital heart surgeries/year occur at centers 80 miles apart. 3 periods were assessed: Period 1-before comprehensive ASO protocols (11/82-8/95- center 1 & 3/92-11/99-center 2); Period 2-comprehensive ASO protocols in place at center 1 (9/95-11/99); & Period 3-comprehensive ASO protocols in place at centers 1&2 and regional sharing of surgical services had occurred (12/99-5/02). The same surgeon performed all ASOs during Periods 2/3, allowing assessment of regional sharing of outcomes.
**Results:** 90 consecutive pts with d-TGA (+VSD-37%, aortic obst=10%, coronary artery defect-5%, PS-3%, dextrocardia-1%) had an ASO. NY State-reported morbidity data for 66 pts since 3/92 included significant differences for Periods 1 vs 2/3 in: 1. Preop acidosis &/or inotropes (5/19 Period 1, 0/23 Period 2, 0/24 Period 3; P=.038) & 2. Postop-VF,CPR, unexplained surg/cath & ARF (7/19 Period 1, 2/23 Period 2, 1/24 Period 3; P=.004). Mortality had a significant difference for periods 1 vs 2/3 (15/43 Period 1, 0/23 Period 2, 0/24 Period 3, p<.001). Period 1 mortality did not differ by center, era, or volume. There were no significant differences in performance between the 2 centers in any time period. There were significant performance improvements between Periods 1 & 2/3. There was no significant degradation in performance between Periods 2 & 3.
**Conclusions:** Medium-volume centers can achieve minimal ASO morbidity and mortality by utilization of comprehensive ASO protocols and a full-time congenital heart surgeon. The shift from one surgeon at one center to one surgeon at two centers resulted in comparable results at both centers without loss of quality.

### 1120-161 Neurodevelopmental Outcome of Neonatal Congenital Cardiac Surgery: Preoperative Lactate Levels Are Predictive for Outcome

Paul M. Verheijen, Lukas A. Lisowski, Caroline C. Geerts, Neeltje E. Sins, Ger B. Bennink, Erik J. Meijboom, University Medical Center Utrecht, Utrecht, The Netherlands

Background Attempts have been made to identify indices that may predict outcome or morbidity of congenital heart disease, in the view of a declining mortality. Prenatal diagnosis has shown to decrease pre-operative acidosis. This study is aimed at the evaluation of parameters of acidosis and their predictive value.
Methods and Results All pre- and postnatally diagnosed patients, requiring surgery for structural heart disease within the first 31 days of life were included (n=117). Pre-operative values of lactate (Prenatal versus postnatal mean ± SEM; 3.03 ± 0.40 vs. 6.39 ± 0.59 mmol/l; p<0.001), pH (7.26 ± 0.02 vs. 7.24 ± 0.01;p=0.62) and Base Excess levels(-6.87 ± 0.71 vs. –7.84 ± 0.59;p=0.30) were retrieved. The occurrence of neurodevelopmental problems, including the need for special tutoring, the occurrence of neurological problems or reduced cognitive functioning. Neurological problems included a shortfall in locomotorics, speech, hearing or coordination of movements, the occurrence of recurrent epileptic seizures or an asymmetrical development of movements and finally an anomaly on cerebral echo or MRI Patients were divided into groups according to blood levels of parameters of acidosis, using ROC curves for determining cut-off values for pH, Base excess and lactate.
Results: No significant difference in neurodevelopmental outcome was found using values for pH or Base Excess as a cutoff level. Pre-operative lactate values exceeding 6.1 mmol/l resulted in a significant difference in neurodevelopmental outcome. Of the children with a pre-operative lactate lower than 6.1 mmol/l, 15.1% had neurodevelopmental events in later life, compared to 40.9% of the children with a lactate exceeding 6.1 mmol/l (p=0.031).
Conclusions Pre-operative lactate values have a prognostic value on neurodevelopmental outcome, with lower lactates showing a better neurodevelopmental outcome. The limited prognostic value of pH can be explained by the fact that pH can be easily corrected, while lactate better reflects the overall oxygen debt experienced by the patient with congenital heart disease.